Case Study: Sheffield, AL

December 1, 2015

Overview

In the spring of 2014, the U.S. Environmental Protection Agency, Region 4 - Atlanta (EPA R4), and the Alabama Department of Environmental Management (ADEM) assembled a team to conduct an Energy Management Initiative (EMI) for Alabama Water and Wastewater Utilities. In August 2014, Tommy Barnes, Civil Operations Manager of Sheffield Utilities and Kenny Nunley, Chief Wastewater Operator, accepted the invitation to be one of the ten utilities to participate in the EMI.

About the City of Sheffield

Sheffield is a city of approximately 9,000 in Colbert County. Situated in picturesque northwest Alabama on the Tennessee River, Sheffield has a rich cultural history, from American Indian heritage to the industrial revolution, and even has made its mark on the world music scene, being home of the famous Muscle Shoals Sound recording studios. Sheffield Utilities provides water, sewer, electric and gas services to the City.

Sheffield Wastewater Plant

The Sheffield Wastewater Treatment Plant (WWTP) treats approximately 1.2 million gallons per day (mgd) of municipal wastewater with an influent $CBOD_5$ of approximately 80 mg/l. The plant uses an extended air activated sludge treatment process and is designed to treat up to 3.9 mgd at average daily flow conditions. The plant has three one-million gallon aeration basins (two presently used) and two one-million gallon final clarifiers. The final effluent is discharged to the Tennessee River, about six miles downstream of Wilson Dam. The monthly average NPDES effluent limits for $CBOD_5$, total suspended solids, and ammonia nitrogen are 25, 30, and 25 mg/L, respectively. The WWTP consistently produces a high quality effluent with $CBOD_5$ values averaging less than 3 mg/l, TSS values averaging 5 mg/l, and NH_4-N averaging less than 2 mg/L.

Optimizing Operations: Energy Savings

Plant upgrades were recently completed including providing aeration by three 125-hp positive displacement blowers with variable frequency drives. Improved aeration efficiency was achieved by running one blower 70% of the time at 50-70% speed to provide diffused aeration to both basins. The team identified that the dissolved oxygen (DO) control system could be further optimized by altering the DO setpoints, thereby making the plant run anoxically (shutting off aerator) for 4-6 hours per day. This control system change was made with no capital outlay yet saved a significant amount of energy.

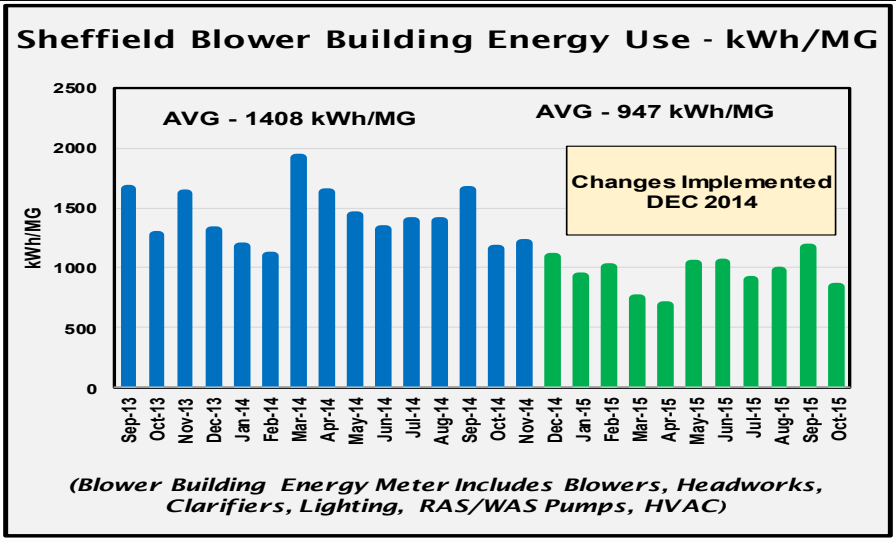
Not Just Saving Energy!

Sheffield has realized savings in energy cost by changing its plant operation to optimize aerator efficiency–incurring lower power (kWh) used per million gallons treated. Close operator oversight was necessary to implement this energy savings initiative, and Sheffield's operators do an excellent job keeping the plant running at peak efficiency. The change in operating scheme has also yielded other benefits to the environment: reducing the amount of nitrogen in plant effluent by 19.3 tons per year and reducing green house gas generation. Plant management continues to seek additional ways to implement energy savings by addressing plant lighting and sludge management improvements.

Sheffield Wastewater Treatment Plant

Results Summary (achieved at no implementation cost):

- **Blower Bld. Energy Savings:** 20% in kWh/MG
- **Annual Rate of Cost Savings:** $9,000
- **Cumulative CO2 Reduction:** Over 71 Tons/year
- **Effluent Nitrogen Reduction:** 19.3 Tons/year (66%)



For More Information: Jim Grassiano at ADEM at gwj@adem.state.al.us
Kenny Nunley at Sheffield Utilities at knunley@sheffieldutilities.org